THE AMERICAN JOURNAL OF

OPHTHALMOLOGY.

VOL. XI. MARCH, 1894. No. 3.

ORIGINAL ARTICLES.

DOES HYPEROPIA BEAR A CAUSATIVE RELATION TO STRABISMUS?

BY C. M. HOBBY, M.D., IOWA CITY, IA.

When a given result does not always follow the alleged cause; when the alleged cause is frequently absent when the result occurs; when the alleged cause may not only be absent, but a condition acting directly opposite present, and the result follow; when a diametrically opposite result, sometimes follows when the alleged cause is present; we have a right to doubt the causative relation, even though the alleged cause and result are co-incidently present in 77% (Donders) of the cases that occur. The rapid strides of physiological optics have led to the acceptance without question, of many theories having their foundation in the consideration of the eye purely as an optical apparatus, to the neglect of stuctural and vital conditions. Amongst other and similar theories, the consideration of the function of binocular vision as a matter of innate, or inherent, adjustment of the movements of the two eyes, in

pursuance of the dictates of a "nerve center" which compels convergence in exact ratio to accommodation, seems unwarranted by analogy, and unsupported by facts.

Landolt in his treatise on "Refraction and Accommodation of the Eye" (Am. Ed., p. 357) referring to Mauthner's explanation of some of the above obstacles to the full acceptance of Donders theory prefers "to acknowledge that many cases of convergent strabismus are still beyond our comprehension." But the trouble with Donder's theory is, that having found a majority of the cases of convergent strabismus with H. he assumes that there must be a causative relation, and proceeds to an explanation founded on instinctive action, and on experiments with those who have learned to use both eyes

If we examine carefully the relation between accommodation and convergence, we shall find that it is principally an acquired function, that as it naturally exists, without education, it is irregular and incomplete, like the grasping of an abject with both hands; that a child, born with a blind eye, does not approach towards fixation of the object, discerned by the other eye, but instead usually has some considerable divergence, whether the seeing eye is emmetropic hyperopic or myopic; such an one may, but does not always, stiffen up the muscles of the blind eye under the stimulus of accommodation. Again, we usually find that the eye becoming blind after the establishment of binocular vision, ultimately becomes divergent, and fails to approach the fixing point, whether the seeing eye have E.H. or M.

The function of vision itself, in complete character, determining distance, depth, solidity, concavity and convexity, etc., is the result of acquired experience in interpreting retinal images.

The child acquires binocular vision as it acquires the use of its hands, by practice, only in the case of vision the training of two seeing eyes goes on together, and the first training of the hands is to use one at a time; the eyes, during waking hours, are constantly practiced and, under normal conditions, they become very expert; but it is worthy of consideration, whether

their possibilities of associated action, are much greater than the fullest developement of the musclar functions of the hands and fingers in coincindent work, as is examplified by musicians.

The eye, at muscular rest, normally takes a position so that the visual axes are divergent, even squinting cases usually show divergence when fully etherized; the blind do the same. Tests made by covering one eye during acommodation of the other, so made as to watch the effect, usually show an attempt at co-incident fixation, even hyperopes generally approximate closely to the proper direction, but with all it is but an approximation, with the uncovering, readjustment follows, just as when, with the eyes closed, an attempt is made to bring the fore-fingers of the two hands into quick contact end to end from a little distance, a close approximation is made, which improves by practice, but is not exact, or as when an attempt is made to touch with the eyes closed a determined mark upon paper.

Many persons can direct their mental effort towards the retinal image of one, the other, or both eyes at will; with a slightly colored glass before one eye, they can with both eyes open, see the field with one eye through the glass colored, or with the uncovered eye uncolored, or with both eyes tinted, this subordination of one eye, at will, is a common practice with those that use the microscope, engineers with the transit and ophthalmologists with the ophthalmoscope; this action is undoubtedly the same as the so-called suppression of the visual image by the strabotic patient.

It is conceivable that trivial circumstances in early life may lead to this action on the part of the developing child, and in H. and Ah. the difficulty in securing a sharp image, even of a straight line, is greatly in excess of that in E. and M. The muscular action and relationship to other muscles in converging strabismus is not comparable to paralysis of opposing muscules sometimes exhibited, as in talipes; but, in the early years at least, there is the hypertrophic developement associated, in other voluntary muscles, with repeated action, indicating use in excess of the ordinary work of the eyes in con-

vergence; and while this is mot manifest in the squinting eye, it is also present in the fixing eye; later on, the external excursion becomes limited. We find then that in converging strabismus, the squinting eye does not assume the position of repose, but shows the result of muscular activity; action not rest is the operative condition. Where the mental action in interpreting the retinal image is directed to one eye alone, the action of the other in converging, when the first fixes a near object, is not co-ordinated by the results of repeated experience; (usually also its movement is above or below the point of fixation,) and in the absence of binocular vision no inducement exists for a rectification of position. To use a comparison drawn from Donder's theory, the command for convergence emanates from the brain, the seeing eye responds to it and arrests its movement at the point of fixation, the non-seeing eye responds and in converging strabismus passes on, (not always respecting the axis of movement of the other eye). The above explanation applies equally to divergent strabismus, only in divergent strabismus, the dis-used eye fails to act as strong as its fellow, fails to develop the hypertrophy of the muscle. It applies to all forms of associated refractive conditions except perhaps those cases somewhat rare, in which convergence is associated with myopia of very high amount. In thus attributing strabismus to the habit of monocular vision, the relation of accommodation to convergence is by no means rejected as a factor in the developement; only as an acquired not an innate relationship, it is subordinated to the position of helping to increase a strabismus already acquired. That convergence is not usually performed in exact ratio to accommodation, may be demonstrated very easily, as follows; let one fix their attention upon a star, then cover one eye, suddenly removing the cover the star will be seen doubled and the second star will make a very quick movement of readjustment, this movement is usually in a curve. Sometimes by careful watching, this movement of rectification can be seen by others, and at short range. The movement is not so simple as the release of over-convergence. When a strabotic patient looks

from a distant object to a near one the convergence is at first, and may continue, much in excess of what the relations between accommodation and convergence would require; here the seeing eye is already accommodated for a point and if the action were simply in relationship to the additional accommodation required, the convergence added would be much less than actually occurs. Diplopia is predicated by many writers of the first stages of convergence, but this apparently on insufficient data; as is also the assumption that strabismus is always or usually alternating at the beginning. Alternating squint occurs when the retinal images are equally good in both eyes, (or perhaps it would be better to say when they are *nearly* equal.) It is in alternating strabismus that the "suppression of the retinal image" or the concentration of mental effort, is most marked.

Granting that this concentration of the mental effort upon the image of one eye at a time, which is a function latent in all is the acting cause of strabismus, the methods of exciting this function into undesirable activity, come next to be considered.

It is easy to see that the art of concentrating the mind upon the image of one eye, so readily acquired in adult life may be induced by apparently trivial causes in early childhood and become habitual; thus the careful protection of the eyes of an infant in the cradle, leaves the child often to practice its forming vision with only one eye; sometimes the customary position of the child in the room, or the method of carrying, may do the same, aud to these causes observers of the past have ascribed the production of strabismus. Temporary reliance upon monocular vision[1] may frequently be caused by the diseases of infancy, general and local; in general diseases by the restraints of position, and in minor troubles with the eye, by the swelling, soreness or bandaging, leading to the same habit of monocular vision. Under ordinary circumstances of good and equal vision of the two eyes when the temporary inducements to use one eye at a time have passed, the advantages of binocular vision prevail[2], and no strabismus is left behind, or, as happens sometimes, the squint which had become noticeable

disappears; but where refractive errors of considerable amount exist, or where the inability to secure a sharp retinal image in one of the eyes persists for a long time, as in cases of phlyctænular keratitis, or when, as in anisometropia a decided preference in visual acuteness exists, then strabismus becomes almost certain. In high grades of myopia the only object of which a perfect image can be formed upon the retina is the nose, and hence in these cases the physically strong develop convergence and the weaker divergence. Clinical facts can be adduced to support almost any theory, but it is none the less important to recall, that muscular training, and interference with the selection of one eye for work, is capable of overcoming squint and securing binocular vision, precisely as claimed by the surgeons who treated these cases before the day of Donder's theory.

[1]Binocular vision is present in only a small proportion of the species of mammalia.

[2]There exists however an instinctive relation between the action of symmetrical muscles on the two sides, and even between the homologous muscles of the upper and lower extremities; the infant at first opens and closes both hands in unison and moves the arms and feet together. In the eyes, the up and down and right and left movements are the earliest co-ordinated movements.

CORNEAL TRANSPLANTATION.—THE CAUSES OF FAILURE, AND THE REMEDY.

BY W. J. COLE, M.D.,

Oculist to the Evansville Eye Infirmary.

The results of corneal transplantation, by what may be called the trephine method, have been so unsatisfactory that few, if any, deem it wise to continue their efforts in this direction.

By a close study of the history of these operations the causes of failure are quite discernable; and I am of the opinion that the advancement of ophthalmic surgery will, in the near future, lead us to change the entire mode of procedure, as well as the instruments employed in performing it.

In this day of advanced antisepsis the question of union or healing needs no special attention here. We all get union in a per cent. about equal to that obtained in other plastic operations; but because of later changes our grafts become opake, and perhaps atrophy sets in, within from three weeks' to three months' time.

The discovery of the causes of this opacification of the graft and their successful removal is all that intervenes between us and our triumph.

Putting aside the incidental or contributory causes for the present, none are likely to dispute the affirmation that the opacity is a result of the mal-nutrition of the graft.

It sometimes begins before, and at other times soon after, all inflammatory activity in the eye has subsided. It usually heals well, and remains clear as long as the vascular excitation is active, and only so much longer as it finds itself able to

draw sufficient nourishment through the very narrow band of cicatricial tissue with which it is surrounded.

To me it is evident that it obtains very little nutriment through Descemet's membrane. The functional power attributed to this membrane of carrying nutritive elements to the stroma of the cornea, is greatly over-rated, for I have removed nearly the whole of it myself without interfering in the least with the vitality or clearness of the cornea. If the aqueous be allowed to escape and a part of the membrane be removed, Nature will have supplied a good endothelial substitute equal to every demand by the time the aqueous is again secreted. I am so thoroughly convinced of the truth of this position that I exclude all consideration of this membrane in deciding upon a proper subject for operation.

It has been suggested by some that in this operation all parts of the cornea should be removed except this membrane, leaving it alone intact.

In the first place this procedure is impracticable, and can not be executed except in theory; and, in the second place, nearly all eyes requiring the operation have a fibrinous exudate deposited, in greater or less abundance, upon the inner surface of the membrane which would render the operation a failure so far as vision is concerned, even though the mechanical execution of the operation could be successfully accomplished.

Descemet's membrane is a true elastic membrane covered on the inner side with endothelium, and if it be lacerated it will prove its elasticity by curling up at the lacerated edges. Therefore, apart from its endothelium it is an osmotic membrane, and the functions we have attributed to the membrane really belong to its endothelial covering.

It is also important to remember that the corneal parenchyma is devoid of bloodvessels except a crown of vascular loops extending from one to three mm. within the sclero-corneal junction. But within this vascular crown the vessels are comparatively large.

These are important facts to be remembered in our search for the causes of failure in this operation, and the remedy to be adopted.

THE CAUSES OF FAILURE.

The operation was made too easy by the instrument that was offered for it performance.

I refer to the corneal trephine, an instrument that cuts through the cornea at nearly right angles to its surface, and at a distance of two or three mm. from the sclero-corneal junction.

This manner of incision gives the least possible surface for union, and also the least chance for the establishment of nutritive currents, whether these currents be by endosmosis, imbibation, or vascular encroachment.

An eye operated on by this method shows a ring of cicatricial tissue surrounding the central, and therefore all the important visual part, of the cornea; and on either side of this ring there is non-vascular corneal stroma.

This cicatricial band, like other scar tissue, is more dense, and, therefore, less pervious to nutritive material than normal tissue.

This condition alone is sufficient to place the life of the graft in great jeopardy, and is one of the prime causes of the many failures already made and recorded.

A LAW OF PLASTIC SURGERY VIOLATED.

Another cause of failure is found in the fact that the portion of cornea trephined from the animal's eye is made to exactly fit into the aperture made in the patient's cornea.

This violates the most important law of plastic surgery, by which we are required to cut the graft from one-fifth to one-third larger than the wound to be covered by it.

But the surgeons have not been at fault in this. The fault lies in the instrument used in cutting the aperture and the graft.

The shape of the edges of the wound, both in the eye and in the graft, is such as to make it impossible to obey this rule and still obtain any reasonable degree of coaptation between the surfaces to be united.

If the graft were cut with a diameter but one-fifth greater than that of the corneal wound the graft would be so cupped

by coaptating the outer edges smoothly all round that the inner edges would be at least 0.5 mm. apart, leaving an open triangular wound all around with its base inward. If such a wound should heal, which is very doubtful, it would be filled with cicatricial tissue; in which we should lose as much by increased interruption of circulation as we should gain by the increased size of the graft.

For these reasons, no doubt, ophthalmic surgeons have been content to make the graft equal in size to the wound to be filled by it, and have, in every instance so far as I have learned, met with ultimate failure and humiliation.

CONTRACTION OF THE GRAFT.

From the contraction of the graft several evil results are to be anticipated. If we suppose it to contract but one-fourth, or, perhaps, one-fifth of its diameter in the process of healing, this would cause considerable traction upon the surrounding tissue, and keep the graft continually on the stretch, which could not fail to interfere very greatly with its nutrition. With this cause superadded to that of a misplaced cicatrix it would seem marvelous if degenerative changes did not take place in it.

We are also to expect a shallowing of the anterior chamber, not from the bulging forward of the lens and its ligament, but from the recession of the cornea. But the ultimate result can but be the same, except in the latter case the anterior chamber may be entirely obliterated, which interferes with the free and normal movement of the iris. We would also expect this condition to cause a dangerous increase of tension in the eyeball, both by the actual decrease of the intra-ocular space by the contraction before mentioned, and by plugging up the angle of filtration, and thus preventing the normal circulation of the intra-ocular fluids. Then we should have a serious case of glaucoma in which an iridectomy would give little promise.

It will be noticed that all of these sequelæ add their potency as direct or indirect causes of the mal-nutrition of the graft that ultimates in final opacity.

Whether the trephining method would give any better results if an instrument were used large enough to cut through the apparent sclero-corneal junction is undetermined. It would at least place the cicatrix in the most vascular, and therefore the most favorable point, while all the other causes of failure would still hold against it.

Furthermore, the dangers of trephining at this point are much greater owing to the close proximity of the iris, and the almost certainty of wounding it and causing serious hæmorrhage and iritis. So it appears that the slight advantages promised, scarcely compensate for the increased danger.

From all points of view it seems better that all trephining methods be discarded, and means devised that will reduce the causes of failure heretofore to a minimum.

It now seems that nearly, if not all, those who have operated by this method have already abandoned it, and the arguments advanced here come rather in the nature of a justification of their action; and they are offered also for the further purpose of deterring others from attempting it by this method.

THE REMEDY PROPOSED.

I would suggest here that the cornea is a tissue of low vitality, perhaps as low as any in the body except the membrana tympani, and requires but little nutriment to sustain it. For this reason we ought to be exceptionally successful in transplanting it.

And we certainly shall be, when we shall have discovered the proper method and recognized and eliminated, as far as possible, every cause of failure as indicated by past experience.

In the selection of a subject for corneoplasty the rules that govern in other equally serious operations should govern in this. If the indications were clear, and the patient was in a good condition for a cataract operation, I should not hesitate to perform corneoplasty. The subject need not be young, but if aged, should have a fair constitution uninjured by alcoholism or debauchery. His general condition should be looked after;

the eyelids should be carefully examined for patches of inflammation, and for misdirected cilia. The lachrymal canal should be irrigated with a good antiseptic solution daily for about four days before the operation; and a similar solution should frequently be applied to all parts of the conjunctival cul de sac.

The patient's cornea should be measured with a small compass, and an animal, preferably a dog, found, whose cornea measures two or three mm. more in diameter than that of the patient.

His eyes should be put through a preparation similar to that of the patient, and his acquaintance should be kindly but zealously cultivated. At the proper time he should be firmly strapped to a table close to that occupied by the patient.

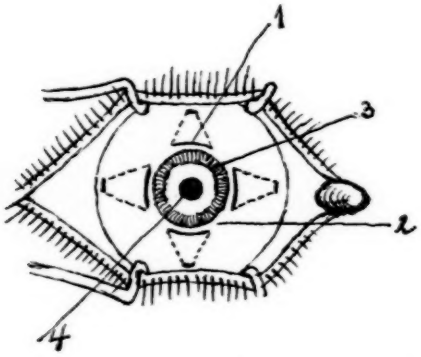

FIG. 1.—Showing eye of patient prepared for the graft. 1. The cut through the limbus. 2. Space to be freshened, 3. Oblique cut through cornea and sclera. 4. Pupil, iris not shown.

The patient should be placed on his back with his face on a dead level, and after the speculum is introduced, a small soft sponge, cupped to fit the curvature of the eye, should be saturated with an eight per cent. solution of cocaine mur. and layed on the eye, care being taken that it does not flow into the lachrymal canal.

The surgeon should pick up with fixation forceps a fold of

conjunctiva over and a little in advance of the insertion of the superior rectus, and with a knife begin an incision three mm. to the right of a vertical line through the center of the pupil, and one mm. behind the apparent sclero-corneal junction with the side of the knife flat against the cornea, and its edge toward the left.

Pass the knife back through the limbus toward the center of of the tendon of the superior rectus at a point about eight mm. from the cornea. When the point of the knife has passed through the limbus, and into the sclero-conjunctival space, it must be carried to the left making an incision six mm. long, all points of which must not be further than one mm. from the visible cornea. The edge of this incision must not be haggled, nor must the opening made be stretched very much as it is necessary to retain the full elastic power of this band in order that it may hold the graft more firmly in position. The incision is the base of a triangular opening, the apex of which should be eight mm behind over the center of the tendon of the superior rectus. The apex should now be snipped across the tendon with the scissors, and a probe or small hook passed from base to apex to see if there be any uncut subconjunctival tissue. If any be found it must be freely divided. The narrow strip lying between the incision and the cornea must now be thoroughly freshened by cutting or scraping off the conjunctival covering.

This process must be repeated in every detail over each of the three other recti muscle tendons. While the surgeon is making the fourth and last subconjunctival opening, an assistant should chloroform the animal to which the surgeon next turns his attention.

With forceps he picks up the conjunctiva over the center of the tendon of the superior rectus eight mm. posterior to the cornea and with knife or scissors he cuts the apex and sides of a triangular flap the base of which is to be seven or eight mm. at the limbus which must be left intact.

After this he proceeds in like manner to make an exactly similar flap over the remaining three recti tendons.

The animal is now left in the hands of the assistant who has been instructed to pass a half-curved needle containing split silk through the apex of the flap, tying the two ends of the silk together, leaving the knot near the needle's eye.

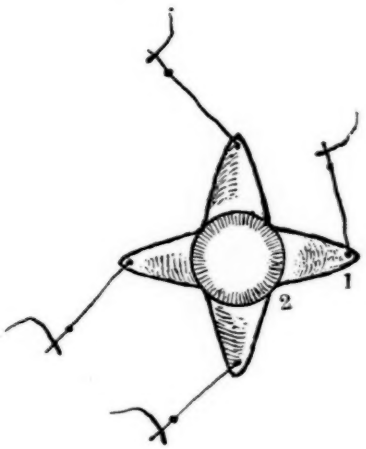

FIG. 2.—Showing the graft after removal. 1. Conjunctival flap. 2. Oblique cut through the cornea and sclera.

The surgeon now begins the most difficult part of his work, the removal of the patient's cornea, which requires a stout heart and a steady hand.

The cornea is usually found to be so densely opake that it is not safe to pass a knife through the anterior chamber, which would have to be done blindly. He must therefore fix the cornea with a sharp hook or ophthalmostat, and with the edge of the knife begin his incision at the sclero-corneal junction, passing it as obliquely through the cornea as possible. (See Figs. 1 and 3).

If he could leave all of the inner flap of the cornea except that which would cover a semi-dilated pupil it would be all the better. But in any case he should cut through the crown of corneal vessels that are near the limbus, or he will increase the danger of interrupted nutrition, and consequent late opacity of the graft.

A careful effort should be made to cut one-half through the cornea all around before the anterior chamber is opened at any point.

If this is accomplished the hook or ophthalmostat had better be substituted by delicate forceps with which the cut edge may be grasped and the cornea depressed in the center which will greatly facilitate splitting it towards the center.

But if one fails to save as much of the inner surface of the old cornea as we have indicated, ordinary care will enable one to make the incision so obliquely through the vascular corona as to obtain a cut surface three times the breadth of the thickness of the cornea. This not only gives a good surface for union, but also divides the vessels and inter-stromal spaces on different planes. The histology of the cornea indicates the importance of this statement. For between the individual bundles of the cornea, and also between the lamellæ formed from the bundles, open spaces exist, which are filled with lymph and are called lymph-spaces. These are connected with each other by numerous minute lymph-canals, constituting a continuous system of lymph-passages that permeate the entire cornea. This system is designed for the circulation of the lymph, upon which the health and life of the cornea depends. Therefore in order that these vessels be given opportunity to heal on different planes the cut should be made through the cornea as obliquely as possible. But with the greatest care we frequently fail to obtain a cut surface more than two mm. in breadth at the narrowest point.

The surgeon having removed the old cornea, now turns his attention to the removal of the graft, the prepared flaps of which the assistant has threaded as instructed.

The assistant holds the four needles together out of the surgeon's way while he grasps with smooth forceps one of the flaps near the limbus, and with a knife cuts down close to the sclera, and through that portion of it that over-laps the inner corneal border, as obliquely as possible into the anterior chamber.

It is not necessary in this case to cut all around the cornea

before entering the anterior chamber, except he should choose to do so, as we intend the animal shall lose his eye in any case. Hence the surgeon should give all his attention to the obtainment of a proper obliquity and smoothness of the graft. When this incision is properly completed, he has but to repeat the same process at each of the other three flaps, and with any uncut tissue between them, when the graft is removed and held by the four threads.

It should be dipped into a warm solution of boroglyceride, or other antiseptic, and gently layed on the wound exactly as it is intended to remain. There must be no turning or twisting, neither removing and replacing of the graft. It must be placed exactly right the first time.

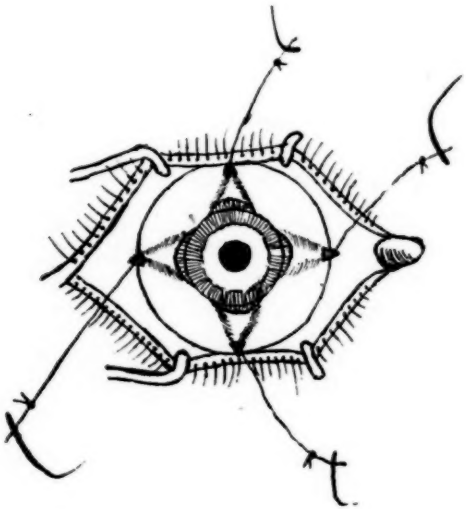

FIG. 3.—Showing the eye after the application of the graft.

Now a needle is to be passed through a subconjunctival wound from base to apex and the flap drawn gently after it while counter-traction is made with a sharp hook hooked into the sclera at the edge of the wound.

The opposite flap is next treated in the same way, and after-

wards the two remaining flaps. They are all now to be drawn taut, which will give the cornea a conical appearance since the grafted cornea must be two or three mm. greater in diameter than the one removed.

The tip of each of the flaps will extend through the small openings in the conjunctiva, and if the graft fits nicely all around, may be snipped off some distance from the opening, which will liberate the threads also.

If there should be a tendency in the flaps to contract beneath the conjunctiva, or if the edges of the wound tend to separate or bulge up between the base of the flaps, a different course should be taken.

One of the double threads should be cut between the needle and the knot; one tine of the forceps passed beneath the rectus tendon, the other over the flap, and a short stitch taken through both the flap and the tendon. But this, if done with one flap, must be done with all so that traction caused by later contraction be equally distributed.

When all is completed the eye is, of course, to be dressed antiseptically, and the patient not allowed to stir for four or five days except by the aid of nurses. His bowels must be kept inactive, and he is to have no food that requires chewing.

Solution of atropia sulphate should be instilled between the lids sufficiently to keep the pupil dilated for at least two reasons: First, it is a preventive of ciliary congestion; and secondly, the iris being held near its scleral margin is thickened and therefore helps to hold the inner margin of the wound in coaptation until union takes place.

The assistant should enucleate the animal's eye, who should receive gentle care and treatment until he shall have recovered.

After yielding an eye for the benefit of man he should receive of man humanitarian treatment.

It remains for us to briefly enumerate the advantages of this operation, and we shall conclude:

1. It admits of our using as large a graft as we think necessary, yet the elastic openings in the limbus, if properly made, will hold it in good position.

2. The elastic band also gives us circular and uniform union without any bulging at points intervening between the flaps because of the largeness of the graft.

3. It furnishes the largest surface possible for union, offering the best opportunity for healing in a manner to allow the greatest freedom for the passage of nutritive elements through the lymph-channels of the cornea itself.

4. Large additional channels of nutrition are afforded, without the intervention of any corneal scar, through the large conjunctival flaps.

5. The cicatrix is placed obliquely through the most vascular area in the border of the cornea, and therefore in the most favorable position.

If we suppose that one-half of the aggregate caliber of all the corneal lymph-channels be obliterated by cicatricial contraction, we should still have sufficient sources of nutritive supply to maintain the life of the graft continuously

The greatest objection to this operation is the extreme difficulty of performing it without a rupture of the suspensory ligament of the lens, or such friction on the capsule as might be followed by cataract.

But a good eye, brave heart and a steady hand, can accomplish it.

Besides it should never be undertaken except in cases where there are no other alternatives than this operation or blindness.

PRESBYTERIAN EYE, EAR, AND THROAT CHARITY HOSPITAL OF BALTIMORE. ANALYSIS OF THE SIXTEENTH YEAR'S ANNUAL REPORT.

BY JULIAN J. CHISOLM M.D., LL.D.

The Free Dispensary work for the year 1893 has been large. Ten thousand nine hundred and forty-one persons have been treated, with an aggregate attendance of 31,655. In analysing the work I find much of interest and worthy of note.

One thousand two hundred and sixty affections of the eyelids were treated. While squeezing out the lymph masses is found an excellent practice in trachomatous cases, the Jequirity bean has not been discarded. In pannus I find it more efficacious than any other treatment. My mode of application is to place a little of the jequirity powder on the conjunctival surface In the course of a few hours all the peculiar phenomena belonging to the local irritation of the drug appear, and are usually accompanied by so much pain as to require morphine internally for their relief. In 24 hours the lids are œdematous, and the conjunctiva and cornea are more of less covered with the characteristic greenish yellow exudate. This specific inflammation is of short duration. In three or four days convalescence starts, and steadily continues, until a very marked improvement shows itself in the vision. The accidents which have occurred in the experience of other practitioners, I have not met with, and hence I apply the powder with confidence, expecting permanent good results from it.

In the treatment of tarsal tumors the practice of the dispensary is to open them from the inner side of the lid, and by

means of a sharp steel curette scrape off the epithelial lining of the sac. Blood takes the place of the gland secretion, which makes the tumor as large when the operation is finished as it was before the sac was opened. The blood swelling however undergoes rapid absorption. If the inner surface of the sac has been properly scraped, within ten days the tumor disappears, leaving no trace of its former presence.

In affections of the eye muscles, 310 cases, there has been no peculiar method of treatment followed, except the regular routine one of completely dividing the muscle when an operation was deemed necessary.

Affections of the conjunctiva, 2,454 cases. Although nitrate of silver solutions are found essential for the successful treatment of purulent ophthalmia, and for severe cases of catarrhal inflammation, the solution is never given to patients, to be used by them at their own homes. The strength of the solution is 1%. It is never used more frequently than once in the twenty-four hours, and is always applied by some member of the surgical staff, so that the effects of the previous drop can be seen, at the daily visit, before it is applied again. Under this cauterizing treatment, followed by the thorough cleansing of the eyes every hour in the 24 by a solution of borax, gr. x to the ounce, or a bichlor. hydrarg. solution, 1 to 4,000, I have never lost an eye from ophthalmia neonatorum, which was brought to the dispensary before the cornea had become implicated. In dispensing astringents for conjunctival affections, it is found very convenient to color the solutions. The borax eye drop is made pink by adding a drop of cochineal; the sulphate of zinc solution is made green by the addition of a drop of fluorescin, while the bichlor. of mercury is left colorless. These collyria, in such constant use in the daily working of the dispensary, are known by the patients as pink, green or white drops. It enables the Staff to learn from the statements of the patient what local application has been used.

For corneal ulcers the galvano-cautery is found most efficient in stopping sloughing tendencies, and in promoting cicatrization. The use of the Japanese Hot Box in corneal ulcers,

is one of the greatest comforts the hospital patients enjoy. It is a small tight box made of tin or copper, and about the size of the hand in length, breadth and thickness. In this box a lighted fuse of compressed carbon is placed. A slow combustion goes on for two or three hours, sustaining a steady temperature of about 115 degrees Fahrenheit. When in use, the warm box is enveloped in a handkerchief, folded cravat fashion, and is tied over the painful eye, with a layer of cotton wadding intervening. In hospital language this box is called the "pain killer," because it soothes a painful eye in a marvelous manner, which only the continuous application of heat will do. The Hot Box is constantly in use for all painful eyes whether from corneal, scleral, or iritic inflammations. It takes the place of large doses of opium for the relief of glaucomatous suffering. In hundreds of cases, during the past five years, the Hot Box has proved itself the most convenient appliance in the hospital. In Japan, where they are all made, and by the hundred of thousands, they are found in every household. It was on account of their efficiency as a domestic remedy in relieving abdominal, thoracic, or limb pains in that country that I was induced to use them for the eye and ear. I find them invaluable. They with the carbon fuses can be purchased wherever Japanese wares are sold.

Of lens troubles, 498 were entered on the hospital books for 1893, which makes 5,615 cataract patients seen in the Dispensary since the opening of the hospital 16 years ago: the surgical staff has therefore had a very large experience in the treatment of cataracts. During the past year there were 178 operations. Of these 123 were cataract extractions; 36 with iridectomy and 87 without. During the previous year there were only 27 extractions with iridectomy and 92 without. For the year 1894 extractions with iridectomy will be more numerous, showing a growing tendency in my belief that there is more safety with an iridectomy. Notwithstanding every care in the after-treatment of simple extractions, a certain percentage of iritic hernias will occur. This is the experience of every operator, whether in Europe or America, regardless

of the after-treatment which he may adopt. Last year, after 70 simple extractions which I myself made, there were 5 cases of prolapse of iris, or 7% of such accidents. When it is remembered, that for the last 5 years I have only closed the eye operated upon, and leave my patients to move about their room or lie in bed as they prefer, these results compare most favorably with the percentage of accidents in the clinics of the most skillful European ophthalmic surgeons, most of whom practice the most rigid restraints on the bodies of their cataract patients, keeping them in dark rooms, in bed, on their backs, and with both eyes tied up. When such hernias occur I remove the protrusion of iris early. Whilst I have not lost a single eye from this hernia complication, convalescence is certainly retarded, and hence I consider such an accident very undesirable. I confess that I do not know to what to attribute this accident, and therefore I do not know how to prevent it. In illustration, I will give extracts from the history of two gentlemen who were recently operated upon for cataract without iridectomy. Both were smooth extractions, leaving clean central pupils. Only one eye in each case was involved in the blindness. Under my method of dressing, only the eye operated upon was closed, so that each had an eye left uncovered for use. They were healthy men, between 60 and 70 years of age. They were operatad upon within a few minutes of each other and occupied contiguous rooms in the hospital. One gentleman was of the lethargic type. He went to sleep soon after the operation, and had an uninterrupted nap of several hours. He seemed to have a special gift for sleeping at any and at all times. The other had a severe attack of irritability of the neck of the bladder which came on during the evening of the day of operation. For many hours it kept him passing urine every few minutes, accompanied by intense pain and severe straining. When I visited the hospital the next day I found him still suffering, notwithstanding doses of morphia which my resident physician had administered. I ordered at once a large dose of chloral hydrate, which soon brought relief from pain and with it sleep. The patient who had spent the

first night after cataract extraction in walking the floor, and straining every few minutes to urinate, left the hospital with a perfect, free, central pupil. The other, who led the most passive of lives, had a large iritic hernia which I had to remove. When I do a small iridectomy I have no anxiety for the patient, and I expect a rapid convalescence with a perfect result.

In lost and painful eyes condemned for removal I still perform optico-ciliary neurotomy in preference to enucleation, if the eye is good looking enough to be retained. I have never seen harm come from this course, but on the contrary have been able to retain a painless eye to the decided comfort of many patients. The only trouble that I have found from the ciliary neurotomy is that in some cases the eye pains return, and then the more radical removal of the painful eyeball had to be done. The attempt at saving the eyeball does not make the final removal more dangerous nor more difficult. In treating this class of cases at the Hospital I find 86 optico-ciliary neurotomies standing against 544 enucleations. Evisceration of the contents of the lost eyeball I have abandoned on account of the greater pain and swelling and much more tedious convalescence which follows the operation.

Refraction cases are very carefully worked out at the dispensary. Last year out of 2140 patients needing spectacles, 1057 were astigmatic, who suffered pains in head and eyes when at work. Of the very great value of weak cylinders, .25D., in permanently relieving pain I constantly have proofs. Astigmatism is the common deviation from the emmetropic eye, and its presence among enlightened nations seems rather the rule than the exception. Whilst this fault in corneal construction is so frequently met with, it does not always annoy. It is only when such eyes are called upon for extraordinary or long continued exertion that these small defects cause trouble. Then it is that much eye-strain in continuous reading, writing or sewing, causes pain in the eyes and the head. For the relief of this there are only two remedies, viz.: Rest, abstaining from all work, which the pressing demands of the day will not permit, or removing the cause

of the muscle straining by the wearing of cylinder glasses. By far the most annoying eyes under work pressure are those seemingly perfect but with a small degree of astigmatism. In the grosser defects of corneal curvature seeing is so unsatisfactory that the eyes are not kept sufficiently long at work to cause pain. In hundreds of cases I have been able to permit sewing girls and students to keep on using their eyes all day without pain by the use of a .25 D.C. spectacle. These lenses stop irregular muscle action and give comfort as long as they are steadily worn. That they can not be dispensed with in work without the return of pain is the best evidence of their usefulness. I have had to make patients discard .50D. cyls. and wear .25, the overcorrection causing as much discomfort as when no correction was made.

THE ACTION OF THE HYDROCHLORATE OF SCOPOLAMINE ON THE EYE.[1]

BY THOMAS R. POOLEY, M.D.,

Permanent Member of the Medical Society of the State of New York; Surgeon-in-Chief of the New Amsterdam Eye and Ear Hospital; Professor of Ophthalmology in the New York Polyclinic.

It is the purpose of this paper to briefly summarize some of the observations already published in relation to this drug, and then to give the writer's experience with the same for the past six months.

In the *Klinische Monatsblätter für Augenheilkunde* for 1893, Raehlmann has a paper in which he says that Schmidt, of Marburg, first described this drug as an atropoid alkaloid derived from the roots of the *scopolia atropoides*, and which, like atropine, hyoscine, etc., belongs to the pharmacological group of the tropëines, and as such the instillation of a watery solution in the eye causes dilatation of the pupil. According to Ladenburg, scopolamine as well as hyoscine are contained in hyoscyamus without being identical with the latter. It is rather isomeric with cocaine, but yields quite different integral products.

The preparation was given to Raehlmann by Professor Kobert with the information that after experiments on the lower animals by the internal administration of scopolamine, it showed an opposite effect to atropine, and that its influence on the cortex of the brain was not stimulating like that of atropine, but on the contrary retarded its action. (Later on I shall have some comments to make on the erroneous charac-

[1]Read before the New York State Medical Society, February 7, 1894.

ter of these observations). These last named qua ities led to the expectation *a priori* that the local special effects of the new remedy would be different, especially on the conjunctival blood vessels. Raehlmann, after using scopolamine both on normal and diseased eyes, came to the conclusion that as a mydriatic and antiphlogistic it surpasses all other tropëines, including atropine. In strength of mydriatic effect it resembles hyoscine closely. The remedy does not produce the disagreeable after-effects and double vision which, according to his observations, occur in the use of hyoscine; but it possesses all the advantages which belong to hyoscine in comparison with atropine. He used it during a period of six months in all cases in which atropine is applicable, and also by way of comparison with atropine, and he has found that scopolamine is, in many cases at least, equal to atropine, while in others it is entirely its superior; but the circumstance, says he, which will insure scopolamine an enduring place among ophthalmic remedies is that it can be used for a longer time in a solution equivalent to a one per cent. solution of atropine without producing the troublesome associated symptoms which so often make the continued use of atropine impossible. He further says—but this I do not believe—it is well known that atropine when used as an instillation for any length of time disturbs the appetite. He has never seen this or similar effects from the use of scopolamine. It is only after very large doses of scopolamine that a feeling of dryness of the throat is produced, a symptom which occurs after a very moderate dose of atropine. The state of nervous restlessness, with or without reddening of the face, and quick pulse, which is so often found in patients treated with atropine, never occurred after the use of scopolamine. In cases of incipient atropine poisoning, or in an idiosyncrasy toward atropine, scopolamine renders therefore the best service since it more than supplants atropine in its local effect, and comparatively destroys its general effect.

In cases of iritis, episcleritis with infiltration of the sclerotic, etc., when atropine could not be any longer endured, when the powers of the body were depressed on account of want of ap-

petite, and the general condition of the body was as unfavorable as possible, scopolamine not only improved the eye disease, but also the general health. The remedy surpasses atropine in its influence on peri-corneal injection, and possesses special advantage in suppurative keratitis, serpent ulcer, and irido-cyclitis. As is known under these circumstances, especially in suppurative keratitis, serpent ulcer and irido-cyclitis, atropine is often inadvisable. But Raehlmann has found in five cases that scopolamine caused a diminution in the size of a hypopyon. Scopolamine seems to act far more favorably on suppurating tissues than atropine, probably through its effect on the blood vessels. Scopolamine does not seem to increase intra-ocular pressure, even if there is a pathological increase of tension. If there is a pathological increase of tension the remedy can be borne, therefore it is an indispensable drug in inflammatory conditions, especially in iritis, when they occur in glaucomatous eyes. He has used scopolamine with advantage in several cases of chronic inflammation with secondary glaucoma. In one case of absolute glaucoma with great irritation, strong ciliary injection and hyphæma, the pain ceased, the eye became quiet, and the blood disappeared from the anterior chamber under the influence of this drug. He has not tried it in acute glaucoma. Hydrochlorate of scopolamine acts five times as powerfully as atropine. It paralyzes, like the latter, and in the same degree, the sphincter of the iris, and the accommodation. The duration of the effect is one-fifth per cent. scopolamine compared with one per eent. atropine. (Whether homatropine or sulphate it is not stated). The duration of the effect is about the same—perhaps somewhat shorter with scopolamine than with atropine. It is to be used in solutions of one to two *pro mille* (one-tenth to one-fifth per cent.), which solutions correspond in dose to one-half and one per cent. solutions of atropine. Six to seven drops may be used daily in an adult, or it may be used every fifteen minutes during one, or one and a half hours. With children correspondingly weaker solutions are to be used. It operates best when used in divided doses.

(Report on Therapeutic Progress, *Therapeutic Gazette;* extract from the AMERICAN JOURNAL OF OPHTHALMOLOGY, July 18, 1893).

L. Bellarminow (*Russian Wratch*, No. 17, 1893)—abstract in the *Revue générale de l'ophthalmologie*, July, 1893—also has some observations on the action of scopolamine, from which he draws the following conclusions which are essentially the same as those entertained by Raehlmann: Scopolamine is indicated for the same cases as atropine, especially to determine the anomalies of refraction and accommodation, owing to its marked effect on accommodation which permits of a speedy and accurate determination; in addition, it considerably shortens the period of duration of paralysis of accommodation and mydriasis. Scopolamine is also preferable to atropine in cases of short attacks of inflammation of the cornea. In general, scopolamine has all the good effects of atropine without its bad qualities. The author therefore thinks scopolamine will soon replace atropine in the practice of ophthalmology. Merck (The Market Report for December, 1893) describes scopolamine hydrobromate as a salt of the alkaloid from *scopolia atropoides*, similar in physiological action and use to atropine, but not causing dryness of the throat, nervous restlessness or congestion of the face as in the case of atropine; neither does it affect intra-ocular pressure. Its application as a mydriatic is in one-tenth to one-fifth per cent. solution, which are equal to one-half to one per cent. atropine solutions.

It was shortly after reading these *coleur de rose* reports of the virtues of the new drug (August, 1893), that I began its occasional use—at first to determine whether it had any local anæsthetic properties, which I soon found it did not possess. I then began its use in all such cases in which we usually employ atropine. The preparation I first used, a one-fifth per cent. was made by Merck, and obtained from Fraser's. In all cases where instillations were used by myself, or my assistant, Dr. W. J. Killen, this preparation was employed, but when it was prescribed the patients got it at Weiss' drug store, Thirty-

Fourth Street and Seventh Avenue, which was also stated to have been Merck's preparation.

As a mydriatic to determine the anomalies of refraction, my house surgeon has used it in a number of cases which I will not weary the Society by reporting in detail, but I will briefly give the results. In some instances the instillations were made while the patient was in the hospital—four times within an hour, or at intervals of fifteen minutes—and then the examination was proceeded with. In every instance it was found that the effect had been to produce complete paralysis of accommodation, and that mydriasis was produced in from ten to fifteen minutes, but that it took about three to four instillations to complete the paralysis of accommodation. The completeness of the paralysis of accommodation was shown both by the inability to see in the near, and by the bringing out in the second examination the total amount of ametropia. The duration of the mydriasis and the paralysis of accommodation was from twenty-four to forty eight hours—about the same as homatropine, but much shorter than that of sulphate of atropine. One remarkable result observed by Dr. Killen in several cases was a notable diminution in the visual acuteness after the full effect of the drug on accommodation—*i. e.*, the correction of the ametropia did not bring the vision to the normal standard.

In three cases, all of them occurring in patients who had bought the drug themselves and used it at home, very marked toxic effects occurred. One of them is so remarkable that I shall take the liberty to report it in full. It happened in a girl of about thirteen years, in whom there was a history of convalescence from nephritis following an attack of diphtheria and cardiac palpitation. These facts, however, did not come to light until after the drug had been used. On January 29, 1894, she came to the clinic having used the solution of scopolamine (one-fifth per cent.) six times in each eye, when the most alarming symptoms set in—the child began to stagger, talk in a thick, drunken and foolish way, and at times seemed out of her head, and was very dizzy. At the clinic, the pupils were

found to be widely dilated, there was constant working of the lips and muscles of the face; the pulse was very rapid—120 to 130 per minute—and the heart's action very irregular and rapid. She had a staggering gait which did not allow her to walk without assistance. She complained of needles under her feet on standing; she said there was no dryness of the throat, but there was no erythema of the face. She was kept in the hospital for three hours before she was able to go home. She was given half an ounce of brandy two or three times. Two days later the mother brought her back to have the examination of the eyes completed. She said that all that night the girl raved and was out of her head, and it was only two days after the use of the drug that she seemed to have fully recovered. Two other cases came under my notice only a day or two later, both occurring in healthy adult females in whom the symptoms were the same, but less in degree. In addition both of these complained of dryness of the fauces. Here too the toxic symptoms did not pass off before twenty-four hours in one case, and in the other, forty-eight hours. In all of these cases as the drug was given to be used at home, and a larger quantity prescribed than was needed, more than one drop may have been used, and it may even have run over the face into the mouth. At all events it seems significant that the symptoms occurred only when the drug was used by the patients themselves. The number of instillations too were more than were used at the clinic.

The other cases in which I have used this drug have been mostly in ulcers of the cornea of different types. In one case of serpent ulcer, just the kind in which it is said to be so efficacious, it was noted that scopolamine was used for two days, but the eye was so irritated by it that atropine had to be substituted. In all other affections of the cornea in which it was used, there was a very beneficial effect noted, especially so in one case of suppurative keratitis of traumatic origin in which the healing occurred in a few days. In quite a number of cases of phlyctenular keratitis too it acted very promptly. In one case of kerato-irritis the mydriatic effect of the drug was

very quick, marked and satisfactory. I have not yet tried it in cases of iritis of severe type, or in any case in which there was a tendency to increase in intra-ocular tension, and consequently cannot confirm or deny the very important observation made by the authors quoted, that it does not increase intra-ocular tension. If this shall be confirmed, however, by future experience and observation, we shall have a drug of inestimable value in ocular therapeutics. I am anxious too to try it in cases in which atropine produces the severe form of conjunctivitis which we call "atropine poisoning," for, from the positive statements made we may hope that it will not only supersede atropine in these cases, but will also have a favorable effect on its course when it has already occurred.

My conclusions, then, from my brief trial of scopolamine are: That it is of value as a mydriatic and cycloplegic in the examination of anomalies of refraction; that its action is more complete than homatropine and of about the same duration, and better than sulphate of atropine because its effects pass off sooner; that it is open to the objection, if my observation should be confirmed by wider experience, that it produces toxic effects oftener than homatropine in spite of statements to the contrary; that the temporary amblyopia sometimes induced does not seem to be of much moment; that in cases of short attacks of inflammation of the cornea, especially in some of the suppurative type, it is of special value.

The tendency of the profession to vaunt the therapeutic value of a new drug is well known, and many instances in which those who were loudest in their praises of it soon become equally pronounced in their condemnation, must occur to all of us. That scopolamine, as we have quoted from one of the authors, will soon replace atropine in the practice of ophthalmology is not so well assured, but that it may prove a very valuable addition to the list of mydriatics which we now have, seems to be altogether likely, and we await with interest further details of experience and observation from our colleagues.

NEWS.

A BILL FOR THE PREVENTION OF BLINDNESS IN THE STATE OF OHIO.

The following bill became a law in the State of Ohio, having passed both houses unanimously, March 13, 1894:

SECTION 1. *Be it enacted by the General Assembly of the State of Ohio,* That should one or both eyes of an infant become inflamed or swollen, or show any unnatural discharge at any time within ten (10) days after its birth, it shall be the duty of the midwife, nurse, or relative having charge of such infant to report in writing within six (6) hours to the physician in attendance upon the family, or in the absence of an attending physician, to the health officer of the city, village or township in which the infant is living at the time, or in case there is no such officer, to some practitioner of medicine legally qualified to practice in the State of Ohio, the fact that such inflammation, swelling or unnatural discharge exists.

SECTION 2. Any failure to comply with the provisions of this act shall be punished by a fine not less that ten dollars ($10.00) nor more than one hundred dollars ($100.00), or imprisonment for not less than thirty (30) days, nor more than six (6) months, or both fine and imprisonment.

SECTION 3. This act shall take effect and be in force from and after its passage.